MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

TSN2101 – OPERATING SYSTEMS

(All sections / Groups)

22 OCTOBER 2018
9.00 a.m - 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 6 pages with 4 Questions only.

2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print all your answers in the Answer Booklet provided.

QUESTION 1

a) What are the THREE issues associated with process creation in an operating system? List down the possibilities of each issue.

[5 marks]

b) Multicore systems present certain challenges for multithreaded programming. Briefly describe any three challenges.

[3 marks]

c) State any THREE reasons for executing the process at different site(s) under the control of distributed operating systems rather than the initiated site (process migration).

[3 marks]

d) CPU scheduling algorithms can be classified into preemptive and non-preemptive types. State the major difference between the two types.

[2 marks]

e) Operating systems (OS) are interrupt driven. How are interrupts handled by the OS?

[2 marks]

Continued ...

QUESTION 2

a) Consider the following set of processes:

Process	Burst-time	Arrival time
P1	5	0
P2	2	2
P3	8	4
P4	4	5
P5	5	7

i) Draw the Gantt charts illustrating the execution of these processes using **Pre-emptive Shortest Job First (SJF)** and **Round Robin (RR) (quantum = 3)** scheduling.

[2.5 + 2.5 = 5 marks]

ii) Calculate the average turnaround time for the Pre-emptive SJF and RR algorithms?

[1 mark]

iii) What are the average waiting time for both algorithms?

[1 mark]

b) What is the meaning of the term 'busy waiting'? What other kinds of waiting are there in an operating system?

[2 marks]

Continued ...

c) Consider the following system with **FIVE** processes and **THREE** resource types:

- A has 8 instances
- B has 16 instances
- C has 12 instances

The snapshot of the system is given as:

Process	Allocation A B C	Max A B C
P0	1 4 2	8 4 8
P1	2 2 2	4 3 2
P2	1 3 1	4 5 3
P3	1 1 4	5 6 8
P4	1 4 1	7 5 3

Available A B C

Answer the following questions using Banker's algorithm:

i) Find the *Available* vector for A, B and C.

[1 mark]

ii) What is the content of the matrix *Need*?

[2.5 marks]

iii) Find a sequence of processes that will get the system into a safe state, if there is any. Show all required steps.

[2.5 marks]

Continued ...

QUESTION 3

a) Assume that a system has a TLB hit ratio of 80%. It requires 20 nanoseconds to access the TLB, and 250 nanoseconds to access main memory. What is the effective memory access time in nanoseconds for this system?

[2 marks]

b) Identify the page numbers and offsets for the following address references (Given as decimal numbers). Assume the page size is 6 KB (1 KB = 1024 B).

- 30455
- 50055
- 655
- 7255

[0.5 + 0.5 + 0.5 + 0.5 = 2 marks]

c) Consider a system that uses a three-level page table with page size of 16 KB and 64-bit logical addresses. The first 16 bits of the address serve as the index into the first-level page table, and the last 8 bits serve as the index into the third-level page table.

i) How many bits are needed to specify the second-level index?
ii) How many entries are in a level-one page table?
iii) How many entries are in a level-two page table?
iv) How many pages are in the virtual address space?

[0.5 + 0.5 + 0.5 + 0.5 = 2 marks]

d) What is the effect of allowing two entries in a page table to point to the same page frame in memory? Explain how this effect could be used to decrease the amount of time needed to copy a large amount of memory from one place to another. What effect would updating some byte on the one page have on the other page?

[3 marks]

e) Suppose that a disk drive has 2000 cylinders, numbered from 0 to 1999. The drive is currently serving a request at cylinder 1045, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is

75, 1355, 925, 1665, 1035, 1315, 1215, 1715, 225

Starting from the current head position, what is the **schedule** and the **total distance** that the disk arm moves to satisfy all the pending requests, for each of the following disk-scheduling algorithms?

- FCFS
- LOOK

[3 + 3 = 6 marks]

Continued ...

QUESTION 4

a) Consider the following page reference string:

2 1 3 4 1 4 3 1 2 3

Assume the availability of **THREE** frames and all the frames are initially empty. Consider the **First-In-First Out (FIFO)**, **Least Recently Used (LRU)** and **Optimal (OPT)** page replacement algorithms for Virtual-memory management.

- Identify the number of page faults that would occur if FIFO is used.
- Identify the number of page faults that would occur if LRU is used.
- Identify the number of page faults that would occur if OPT is used.

Show all steps involved.

[2 + 2 + 2 = 6 marks]

b) Consider the following page table in memory.

Frame	Valid/Invalid Bit
4	i
2	v
6	v
24	i
16	i
10	i
8	v
12	i
15	v

Assume that the page size is 4 KB (4096 B), check whether the virtual addresses below generate page faults. If the address does not generate a page fault, identify its physical address.

i) 654
ii) 11444
iii) 22574
iv) 33604

[2 marks]

Continued ...

c) A 2 TB hard disk with a 64 KB block size is using bitmap to maintain free space list. How much disk space (in MB) is needed to store the bitmap?

[2 marks]

d) One problem with contiguous allocation is that the user must pre-allocate enough space for each file. If the file grows to be larger than the space allocated for it, special actions must be taken. One solution to this problem is to define a file structure consisting of an initial contiguous area (of a specified size):

If this area is filled, the operating system automatically defines an overflow area that is linked to the initial contiguous area. If the overflow area is filled, another overflow area is allocated.

Compare this implementation of a file with the standard contiguous and linked implementations, in terms of overhead.

[2 marks]

e) In Windows, state the services provided by the process manager to processes and threads.

[3 marks]

End of Exam